

Proposed Process to improve accuracy of Bonneville Spillway Discharge

Background: Since additional flow deflectors were installed at Bonneville Dam Spillway in 2002, a discrepancy between the computed inflow (The Dalles Outflow + tributary inflow) and outflow from the Bonneville Dam was identified. The discrepancy varied but was on the order of 10 to 20 Kcfs. At first it was not known if there was a problem at The Dalles or Bonneville. Analysis pinpointed the problem was at Bonneville. GDACS spill related tables were revised in March 2004 but the problem still persisted. During July 2004, it was discovered that the spillway gates at Bonneville had been miscalibrated and actual gate openings were up to 0.3 ft. less than was reported. The greatest impact on discharge was at smaller gate openings. As the gate openings increased, the discrepancy in the reported gate opening had less influence on the actual discharge through the spillway.

Goal: Verify, quantify and correct inaccuracies in gate openings and rating curve at Bonneville Spillway and document differences between actual and reported spill volumes prior to spring 2005 spill season.

Proposed Procedure:

- 1. Document and quantify flow imbalances between The Dalles and Bonneville Dams with the old (prior to 2002) and new (after 2002) spill patterns for spill volumes of 50k, 75k, 100k and 125k cfs.** At least two flow periods for each spill volume will be used to ensure repeatability of results. A minimum of 16 flow balances will be performed (8 with old pattern and 8 with new pattern). Time periods with relatively stable Dalles outflow, Bonneville outflow and Bonneville pool elevation will be selected to minimize errors. NWD Reservoir Control Center (RCC) will perform this function.
- 2. Recalibrate gates and document old vs. new gate opening readouts.** Each of the 18 gates will be re-calibrated by measuring the vertical gate opening and calibrating the gate dial readout to the actual gate opening. The pre-calibration gate opening readout will be recorded for gate openings of .5, 1.0, 2.0, 3.0, 4.0 and 5.0 feet to allow back calculation of actual vs. reported gate openings and associated spill volumes. This will be needed for interpretation of existing and future biological research results. It is estimated that each gate will required 15 minutes to record and calibrate to the actual gate opening. Bonneville Project (project) will accomplish this task..
- 3. Update the spillway rating curve/table for small gate openings (up to 5 feet).** Existing model study results and current design guidance will be consulted to update the discharge coefficients for small gate openings to reflect the changes in gate lip geometry installed in the 1970's to reduce vibration problems on the gates. The greatest differences

will be found at small gate openings up to about 2 feet. NWP Hydraulic Design (HD) will accomplish this task.

4. Compute actual versus reported discharges for the four spill scenarios in item one and the corrections determined in items 2 and 3 above. Using the revised computed discharges, the four spill scenarios from step one will be checked to see if the changes account for the flow imbalances between The Dalles and Bonneville Dam. The goal will be to match within $\pm 5\%$ of the actual computed flows. If the comparisons don't check out within a reasonable tolerance (assumed to be 5% at this time), additional evaluation of the rating curve coefficients will be conducted (the gate opening calibration is independent of the rating curve). Joint effort between RCC and HD.

5. Reprogram GDACS with updated rating curve and document findings. If the changes in steps 2, 3 and 4 above account for flow imbalances, a new spillway rating table will be provided by HD and input into GDACS by Hydroelectric Design Center (HDC). The results of the gate calibration, the rating curve modification and quantification of the flow imbalances will be documented in a report. This will be a joint effort between the project, RCC and HD. The changes and report will be provided prior to the 2005 spring spill season - February 2005.

6. Verification that flow imbalance problem is corrected. Once spill begins in spring of 2005, RCC will perform random flow balance checks between The Dalles and Bonneville projects to verify the changes have corrected the historical flow balance problem. This information will be shared with the region through TMT.

SCHEDULE:

The overall goal is to complete the above effort prior to the start of the next spill season. An interim solution to the gate calibration problem was implemented on 1 August 2004. The interim solution is to manually raise the gates an additional 0.3 feet when spilling at the 75k cfs or below. It is proposed to continue this interim solution for the rest of the spill season (end of August 2004).

It is estimated that the calibration process will take 2 days total. The actual time that each gate is open will be minimized. Spill volumes of up to 10 Kcfs for 15 minutes will be required for each gate calibration. It must be noted that the initial calibrations will be performed at low gate openings and only a check at the 5 ft. opening will be required. It is estimated that an average of 5 Kcfs for the total 15 minutes per gate will be required. Due to project workload and scheduled outages for Bank and Unit maintenance it would be almost impossible to complete this task before the end of August. It is the project's intention to have all calibrations completed no later than Dec. 2004.

The other steps above can be conducted at any time but it will be timed to coincide with recalibration of the gates. It is estimated it will require about one month to complete all the above steps and document the results. Assuming funding is provided in November,

the effort could be completed and coordinated with the Region by the end of January 2005 at the latest.

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